AMENDED ABSTRACT, INCORPORATED AMENDMENTS

IN RESPONSE TO OFFICE ACTION DATED May 31, 2005

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ABSTRACT OF THE DISCLOSURE

~~This paper presents the fabrication and preliminary testing of a novel piezoelectric microvalve. Fabrication has three steps, which are the actuator fabrication, valve body fabrication and assembly of the microvalve. Fabricating an actuator involves cutting piezoelectric and brass beams, gluing the brass and piezoceramic beams into a trimorph sandwich structure, and curing them under pressure at elevated temperatures. Actuators are then wired either by using conductive epoxy or soldering. Valve body parts are constructed from single crystal silicon substrates using deep reactive ion etching (DRIE). DRIE is a subtractive process, whereby a mask is created on the surface of the stock, which will shield the parts that are not to be machined. Refinements in the actuator manufacturing process are made to increase the quality and decrease the fabrication time. Using a photonic probe, tip deflections of the actuators have been tested at various temperature and voltage levels. Currently, the valves are being assembled. Once assembled, multiple microvalves will undergo cold flow testing with air followed by extensive flow extensive flow testing at elevated temperatures with humidified hydrogen.~~

This invention is directed to a fuel cell operable with a quantity of fuel and a quantity of an oxidizer to produce electrical power, the fuel cell including a fuel cell body including a labyrinth system structured to permit the fuel and the oxidizer to flow therethrough; at least a first catalyst in fluid communication with the labyrinth; and at least a first microvalve operably disposed within at least a portion of the labyrinth. The microvalve utilizes a deflectable member operable upon the application of a voltage from a voltage source. The microvalve includes an

elongated flow channel formed therein and extending substantially longitudinally between the first and second ends to permit substantially longitudinal flow of the fluid therethrough and between the first and second ends; and the deflectable member disposed on the valve body, the deflectable member including at least a first piezoelectric portion that is piezoelectrically operable to deflect the deflectable member between an open position and a closed position upon the application of a voltage, the deflectable member in the closed position being operable to resist the flow of the fluid through the flow channel.